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20 September 2021

Australian Academy of Science

Australian Academy of Science Submission to the Economics References Committee inquiry regarding the Australian manufacturing industry

The Australian Academy of Science (the Academy) welcomes the opportunity to contribute to the consultation on the Australian manufacturing industry.

Science and technological progress are central to the advanced manufacturing sector. New manufacturing and the jobs it will support depend on a flourishing, innovative science and research ecosystem.

Manufacturing businesses employ 18,500 (full-time equivalent) people engaged in research and development (R&D), including over 7,000 scientists and almost 8,000 technicians. Manufacturing is the most significant socio-economic objective of private sector expenditure on R&D ($5.3 billion 2019-20) and manufacturing businesses are the second largest investors in R&D ($4.7 billion in 2019-20).

To secure the ongoing success of the Australian manufacturing sector, the future of the science sector must be secured so that Australian Government priorities such as the Modern Manufacturing Strategy may be achieved. The Academy makes the following recommendations for the committee's consideration:

- The Australian Government and universities should nurture strategic and patient investment across the entire innovation pipeline. In particular, they should ensure that the investment in fundamental research does not fall below current levels (22 per cent of overall R&D investment).
- Introduce a program to transition early and midcareer researchers (EMCRs) who have lost positions during the pandemic into roles in the manufacturing ecosystem that will allow their STEM skills to be of use.
- Pursue existing opportunities to utilise the R&D tax incentive to encourage investment in priority research areas, including those that support manufacturing, and boost the employment of PhD qualified Australians in manufacturing.
- The Australian Government should review the cluster funding rates for tertiary courses as a matter of urgency.
- Support the development of an Australian mixed RNA manufacturing ecosystem, including pilot facilities to enable new Australian products to be translated, production of pre-clinical trial components and GMP sovereign manufacturing capability to support clinical trials.
- Develop schemes to build capacity in entrepreneurial and translation expertise, including facilitating greater mobility between research and industry.

The COVID-19 pandemic is challenging Australia's research capability. Our critical national science capabilities are facing losses, driven mainly by university cuts. For example, in the field of earth sciences, two departments have been closed and many academic jobs have been lost across the country in the past year.

Science is needed to support sovereign manufacturing capability

Growth opportunities for the manufacturing sector stem from the research sector, and research and development is critical for Australia to remain internationally competitive.[1] Advanced manufacturing relies on science and the creation of technology, from the conception of ideas through to post-sales service. Exploration for critical minerals will be needed to secure Australian raw materials to facilitate manufacturing related to digital and new energy technologies.

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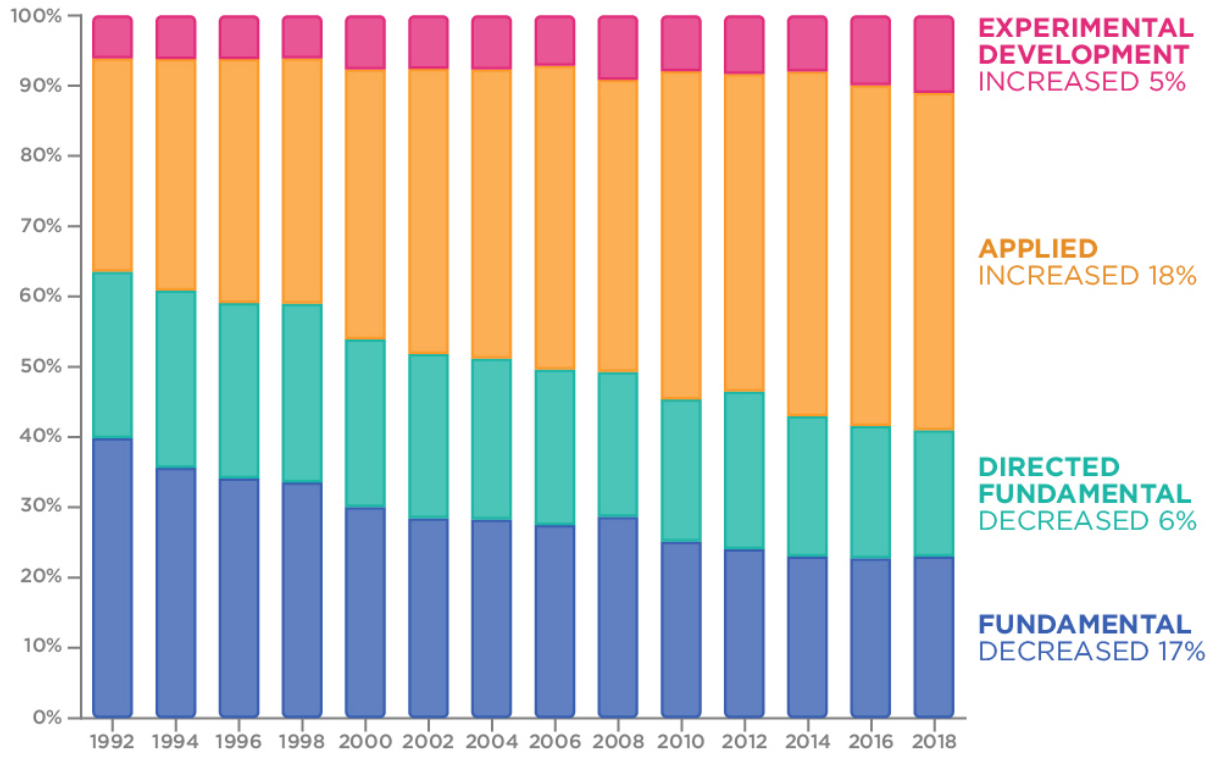
Australia's record in translating science to commercial and societal impact tends to be better in manufacturing. Several exemplar companies have emerged in the past twenty years that have taken science to the market. New ventures are emerging from our universities, drawing on fundamental (or basic) science from chemistry (green steel, zinc bromide battery technology), to physics (quantum computing and applications), to materials science (semiconductors, advanced materials). The time from a basic scientific conception to a commercial product can be measured in the decades. Hence government support for science needs to be consistent at every stage of the innovation pipeline.

Fundamental research has received a declining share of university and government support for decades.[2] This has largely resulted from shifts in policy priorities to support work with anticipated practical and commercial outcomes, rather than fundamental and discovery research.[3]



Graphic republished from 'Science in Australia' by the Australian Academy of Science.[3] Data sourced from the Australian Bureau of Statistics.

The primary purpose of fundamental research is to generate new knowledge and better understand our world. This generates 'scientific capital', which forms a repository from which innovative applications can be drawn. Australia has over 200 schemes and programs to support research and industry engagement, sitting across 13 portfolios. There remains a lack of a cohesive, patient, and national approach to research funding. Such an approach would help enable a flourishing advanced manufacturing sector and collaboration and alignment between industry and research by working towards common goals and priorities.[1]

Counterproductive policy interventions must be avoided, such as reallocating existing funds from fundamental research to applied or translational research. The entire research and development pipeline, stemming from fundamental research, needs to be thriving to support an innovative Australian manufacturing ecosystem. From fundamental research, contributions to manufacturing are made, including discovering new materials or efficient production techniques.

The Academy would like to reinforce the recommendation of Industry Innovation and Science Australia to ensure that investment in fundamental research does not fall below current levels (22 per cent of overall R&D investment) so that it can underpin future opportunities.[4]

Creating the STEM skilled workforce of the future

A Science, Technology, Engineering and Mathematics (STEM) skilled workforce is critical to support the manufacturing industry in Australia. Australia should strive to produce STEM graduates ready to fill jobs and understand how to create companies and new jobs.

The Australian Government's Job-Ready package was intended to incentivise STEM study. Universities have since reported job cuts and course changes, impacting staffing levels in STEM areas – particularly mathematics, physics, and chemistry. These result from legislated changes in cluster funding rates and student contribution levels and the pandemic's ongoing impact on universities. The Academy suggests that the Australian Government review the cluster funding rates as a matter of urgency.

Early and Mid-Career researchers and women have taken the brunt of university job losses. To safeguard this STEM workforce, the Academy recommends introducing a program to transition EMCRs who have lost positions during the pandemic into roles that will allow their STEM skills to be of use, particularly in priority areas within manufacturing, research and development. In addition, barriers to the participation of women in the workforce must be addressed.

Case study – mRNA vaccines

In 2020, the race was on to create effective vaccines that could aid in ending the COVID-19 pandemic. Two of the first vaccines produced by Pfizer/BioNTech and Moderna used a promising 'new' technology – mRNA. These COVID-19 vaccines were the first mRNA vaccines approved for use across the globe and have received substantial public interest as a technology that might offer rapid reformulation to be used against future strains of the virus.

While this technology rapidly appeared into the public consciousness, it could only do so with previous decades of patient investment into RNA sciences worldwide. Given the efficacy and flexibility of mRNA-based vaccines, Australia is now working towards developing a sovereign capability to deal with the ongoing COVID-19 crisis and future pandemics. Australia is well placed to do this, with many world-leading experts in RNA science, biomaterials and biotechnology located within our universities and research institutes.

Through the adoption of policies and strategic investments, opportunities exist to become a leader in RNA science and technology, from knowledge creation to translation and manufacturing. The example of mRNA vaccines demonstrates the importance of sustained programs of fundamental science, patient capital and a diverse manufacturing portfolio.

The Academy recently hosted the National RNA Science and Technology Roundtable. The following recommendations were included in a statement published after the event:

- A local mixed RNA manufacturing ecosystem, including pilot facilities to enable new Australian products to be translated, production of pre-clinical trial components and GMP sovereign manufacturing capability to support clinical trials.
- Facilitate commercialisation and establishment of a self-sustaining RNA biotech industry through new and existing mechanisms, including incentivising the capture of new intellectual property, the R&D tax incentive and proposed patent box initiative.
- Schemes to build capacity in entrepreneurial and translation expertise, including facilitating greater mobility between research and industry.

To discuss or clarify any aspect of this submission, please contact [redacted]

References

1. CSIRO. *Advanced Manufacturing Roadmap*. https://www.csiro.au/en/work-with-us/industries/manufacturing/advanced-manufacturing-roadmap (2016).
2. Australian Academy of Science. How is science funded in Australia? . *Sci. Aust.* (2021).
3. The Australian Academy of Science. Science in Australia . *Curious*

https://www.science.org.au/curious/policy-features/science-australia (2021).

4. Industry Innovation and Science. Driving effective Government investment in innovation, science and research. (2021).